Americans have entered a property regime that pits their stake in a comfortable personal future against their stake in securing habitable environments for themselves and other species. Absentee ownership gives lie to property rights advocates' invocation of stewardship of the land as a feature of proprietorship, but it is not incompatible with their vision of an ever expanding, unencumbered market as the gold mine of the new millennium. It is environmentalists who are confronted with the task of taking the measure of the rights and powers of absentee ownership that have turned millions of Americans, including ourselves, into renters while severing our connection to the land that sustains us.

FLOODS AND LANDSCAPES IN THE INLAND WEST

CONFLICTS BETWEEN ranchers, irrigation developers, and government scientists over the control of flood waters have a long history at Malheur National Wildlife Refuge in southeastern Oregon. My focus is on the ways different groups have responded to floods. Floods shaped, and continue to shape, human responses to landscapes. One piece of land is never entirely separate from another, even if we think that a string of barbed wire forms an effective barrier between them. A bit of dirt kicked free by a cow finds its way into a stream and eventually gets deposited miles away. That sediment clogs the gills of a redband trout, far from where the cow grazed. Floods connect these places, weaving the threads of the landscape together.

For all the ecological benefits floods provide, most people hate them. Floods wipe out human signs of progress: they rip out roads, they destroy crops, they stink up basements, they drown children. Floods are a slap in the face of human industry, and for many people, floods have been a powerful source of frustration and anger. Yet human responses to floods have dramatically differed, and those responses have shaped both landscapes and identities.

Federal resource managers have often managed flood-prone landscapes in ways that confound outsiders. Since the 1930s, for example, managers at Malheur National Wildlife Refuge in southeastern Oregon have ditched wet-
lands, channelized rivers, sprayed Agent Orange over creeks, mowed down willows that managed to escape the poison, and repeatedly poured rotenone into the rivers and lakes to kill carp. Given that ecologists now consider these activities to be among those most harmful to watershed health, one cannot help but wonder: why did managers do this? What led them to make such decisions? What were the effects—ecological and social—of such decisions? And what can we learn from their successes and their failures? Examining the tangled history of flood management in one western watershed will suggest ways that a better understanding of history can lead to more effective resource management.

When bird watchers now flock to Oregon’s Malheur National Wildlife Refuge—one of the nation’s critical areas for migratory waterfowl—they find what looks like a teeming wilderness along the Blitzen River. Winding river channels, riparian meadows, willow thickets, ponds, and marshes create an oasis in the high desert of the northern Great Basin, used each year by up to twenty-five million birds. To the visitor, Malheur seems like a supremely wild refuge from both desert aridity and human industry. Yet wild as it seems, this landscape has been radically transformed by ranchers, irrigators, and wildlife managers.

Few whites settled in the region until the 1870s, put off by stories of marauding Indians, the area’s remoteness from other settlements and transportation networks, and the nature of the land itself. The years from 1854 to 1869 had been particularly wet. While reports of northern Great Basin grasslands had attracted California ranchers to eastern Oregon, they had avoided the Malheur Basin, for it seemed too wet, swampy, and flooded to be safe for unattended cattle.

In 1872, that isolation changed when a short, wiry young man named Peter French rode north out of the Sacramento Valley, searching for grass and water for cattle. Just two years earlier, French had been a hired hand breaking horses for the Sacramento “Wheat King” Hugh Glenn. Soon Glenn trusted French enough to make him manager for his expansion into Oregon, and so, with six Mexican vaqueros and twelve hundred cattle, French spent weeks riding across the northern California deserts, through dusty, dry lands where his cattle had a hard time finding sustenance. French kept heading north, until he rode up over a dusty ridge just west of the Blitzen Valley. What he saw over that ridge delighted him—an abundance of water in the desert. When the party stopped for the night, a discouraged prospector named Porter noticed the cook fire and came for a visit. Porter sold his few cows to French, along with the P brand. Since Porter’s cattle were the only ones in the valley, French acquired informal rights to graze the land as well, to the exclusion of other cattle operators.1 By the time French died twenty-five years later, murdered by a homesteader over contested riparian lands, he had built up those meager holdings into an empire of 45,000 cattle and 132,000 acres.

In the Blitzen watershed, French found himself within a watery world: a maze of streams, channels, wetlands, bogs, alkaline lakes, and lush riparian meadows—all fed by waters from the Blitzen River. Without that water, this would have been a barren desert, unable to support more than a few animals and even fewer people. With the water, it became the center for what was briefly the largest cattle empire in America, and what became some of the most bitter battles between cattle barons and Indians and homesteaders and irrigators and ranchers and environmentalists—all focused on who would win control of the flood waters.

French never wrote home describing what he found that night, but three years later, another rancher described the adjacent Carlisle Valley as “one of the most beautiful valleys in southeastern Oregon, the bunch grass waving over its broad stretches like a grain field . . . in addition to the bunch grass the white sage stood two feet high, rendering it a veritable stockman’s paradise.”2 The basis of this paradise was the natural wealth offered by the wetlands and riparian areas of the northern Great Basin, a geography of basin and range where the rivers flowed, not into the sea, but into briny lakes. Between each fault-block range lay a basin with a moist valley where streams wandered into a maze of wetlands, creating riparian corridors and ephemeral pools that fed into great blue-green salty seas teeming with life. When droughts came, evaporation dried up the lakes into playas, concentrating the salts into a white alkaline crust. These were places of extremes and sudden contrasts—desert interrupted by snowy mountains and great, shallow, salty seas.

For thousands of years before Peter French looked down at this abundance of life, the river had moved across the entire flood plain, using a set of sinuous channels that changed from decade to decade. These riparian communities were anything but stable; floods, changes in rainfall, and changes in animal activities led to dramatic annual changes in the bottomlands. Some years the marshes were lush and green and stretched from one end of the valley to another; the basin filled with water. Other years little snow fell on Sevens Mountain, and by early summer the lowland streams ran down to a trickle, and the riparian meadows turned brown, and the marshes slowly dried. Some years the water was so high that numerous pools and ponds formed in the valley, perfect for brooding waterfowl. Other years few pools
formed, and waterfowl rearing habitat was minimal. Yet because the Malheur Basin was embedded in a much larger network of wetlands stretching from California to Canada along the Pacific Flyway, when droughts struck Malheur, shrinking the ponds and pools, migratory birds could find other places to rest and feed.

Change was at the heart of the riparian landscapes that Peter French so admired. During spring snow melt, the waters rise over their banks and spread over the bottomlands, irrigating lush riparian meadows where wild rye waved six to eight feet high. Such floods could dramatically reshape the riparian lands, as winter storms pulled up entire forests, and spring snow melt swelled the streams, undercutting banks and reshaping sand bars. While destructive in the short term, these floodwaters helped to create the fertility that was soon to nourish Peter French's cattle, for they saturated the soil for weeks and washed organic sediments and nutrients from the uplands over the lowland meadows.

French was a progressive rancher for the times, determined not to follow the standard practice of letting one's cattle loose in the spring and then rounding them up in the fall. Instead, French had his vaqueros ride close herd on the cattle, which made it much safer to run cattle in the wet bottomlands, where untended cattle could founder in the mire. Manipulating water was the key to his success. Since the sagebrush uplands did not seem particularly productive to French, he drained rife marshes, using the water to flood out upland sagebrush, which dies when its roots are submerged. With his water systems, French set out to make the uplands wetter and the swamp lands drier, and both of them better for cattle production. Prim Ortega, a Mexican vaquero who had come up from Sacramento with Peter French on his first voyage into Oregon, testified that French had begun building dams and ditches “all over the place” long before any other settlers came to the Blitzen. French, according to company documents, soon “laid out a plan for the drainage of the swamp by a main canal and the irrigation of all lands between the foothills and the canal, putting the water on the land along the highest lines and using the canal itself as a final drain ditch for the irrigation system.”

French succeeded not by attempting to engineer natural riparian systems out of existence, but rather by recognizing the abundance offered by riparian areas in all their messiness and uncertainty. What made the Blitzen Valley so fertile for cattle raising was not just the quality of its soil, nor the abundance of its water. The complicated connections between these two created the abundance, and annual flooding mediated those connections. Other ranchers looked at the annual flooding of the riparian landscapes along the Blitzen and saw something messy, troublesome, and inconvenient, a natural chaos that either needed to be avoided or engineered away. French looked at these same floods and recognized that they could become the source of his prosperity.

With simple methods of flood irrigation developed by observing and mimicking the natural overflow of water onto riparian meadows during spring floods, French spread water over his drier riparian meadows in the spring, increasing the growth of native hay that he could cut and store for the winter. Streams were encouraged to overflow their banks, just as they had done in creating the natural riparian areas. Rather than trying to reshape the riparian meadows into dry lands and reservoirs, French encouraged water to remain a little bit longer, to spread a little bit wider. These simple techniques of flood irrigation modified, but did not break, the connections between land and water.

Flood irrigation was an imperfect tool. If the field was not perfectly leveled, as no field ever was, water would fill the depressions and just sit there instead of spreading smoothly across the entire field, creating ephemeral wetlands. Even in the late summer, ranchers complained that they could not cross certain sloughs in their fields for fear of miring their horses. To get all parts of the field wet, far more water than each plant needed would be let across the field, and that water might run off the land instead of sinking into the dirt. Flood irrigation relied on snow melt early in the growing season, rather than stored waters from reservoirs. Such flood irrigation had little benefit for farmers trying to grow nonnative crops such as alfalfa or wheat, species that needed water later in the summer to survive. Riparian grasses, or “wild hay,” however, thrived under the early flood waters. Rather than trying to introduce exotic grains as other ranchers were doing, French prospered by harvesting native riparian hay.

Within a few years after French’s success in the basin, the area began to be settled by homesteaders, who soon came to hate him for his monopolies on riparian areas. Flood irrigation of riparian meadows gave French something critical in his quest to control access to grazing: a way to grow and harvest cheap hay for winter feed. As early as 1877, according to Ortega’s testimony, French began putting up hay. Other cattlemen scorned the very idea of winter feeding, believing that it made the cattle lazy and lifeless, or as one cattleman put it, “illustrating the ordinary results of charity to a street beggar.” After the harsh winter of 1879–1880, when most cattle in the region starved to death, winter feeding allowed French to buy out the holdings.
of his neighbors until he controlled nearly all the water sources and riparian areas in the Blitzen Valley.

The wealth of the cattle empires depended directly on the wealth of the riparian meadows. French's genius in manipulating riparian structure, and increasing the action of natural floods without destroying riparian function, was one keystone to the success of his empire. But while French did not try for complete control of the movement of water across the land, he did try for complete control of the movement of people across his land, and their use of water—he soon gained complete control of water rights in the basin. His control of water rights was only an illusion: powerful tensions were brewing in the basin between cattle barons, homesteaders, and irrigation developments.

Flood irrigation in Oregon was an alteration, but one that maintained the connectivity of the riparian area, mimicking and even extending natural riparian functions. Homesteaders and other critics of ranching attacked flood irrigation on these very grounds, arguing that such waste prevented efficient manipulation of the landscape. But the real abuses by ranchers were not ecological (wasting water on riparian vegetation, as homesteaders accused) but rather social (in preventing homesteaders from getting access to water). By the 1890s a few large cattle companies were dominating the irrigated acreage in Harney County. Between 1889 and 1889, the irrigated area of Harney County increased from 26,289 to 111,090 acres (a 322.6 percent increase) while the total number of irrigators dropped from 240 to 228, as large cattle companies bought out the water rights and irrigation systems of small operators. While ranchers gained control of the riparian meadows and began turning the wetlands into what one observer called "giant hay ranches," homesteaders began attacking the very idea of flood irrigation.

By the 1890s, overgrazing and water projects, combined with a few dry years, had sparked an explosive situation among valley residents. As early as the 1880s, the water levels of Malheur Lake had begun to fall as more water was diverted for irrigation, and the lands between the high-water mark—the meander line—and the water line became contested territory. The central conflicts rested on what the boundaries between water and land meant in a place where those boundaries were never fixed, and how those shifting boundaries affected legal title.

Above the meander line was French's land, but between the meander line and the actual lake levels, ownership was uncertain, because the precise nature of that riparian landscape was uncertain: was it water or was it land? Large operators such as French claimed rights to those newly formed spaces because, in their view, it was not land but lakebed, and therefore part of their original riparian claim. Homesteaders, on the other hand, argued these new spaces were true land and therefore should be considered public domain open for settlement. As settlement increased in the basin, human interventions made the water levels increasingly unstable, thereby decreasing the stability of legal title as well. More water diversions from the Blitzen and Selvies rivers were built for irrigation, which lowered water levels further in Malheur and Harney lakes. In the spring of 1881, the sand reef separating Malheur Lake from its smaller neighboring lake, Harney Lake, broke (as legend has it, through the angry kick of a cowboy's boot). Water rushed from Malheur into Harney Lake, cutting a new channel two feet deep. Because Harney Lake's elevation is slightly lower than Malheur Lake, the new channel lowered the level of Malheur Lake, exposing more land bed for people to fight over. Not only did the new channel lower average lake levels, it also made them more unpredictable. In some years, erosion led the channel to become silt-clogged, blocking flow from Malheur into Harney and raising water levels in Malheur Lake, swamping out the squatters. Other years, heavy spring runoff washed out the silt in the channel so that Malheur Lake levels dropped precipitously, even though rainfall was high—exactly the opposite of what people expected.

When homesteaders first moved onto the exposed lakebed in the early 1880s, French raised no objections. In 1894, however, he claimed riparian rights and informed the homesteaders they had to leave. When they ignored him, he started suits in the federal court in Portland, and when the first case was found against him, he appealed the verdict. Some homesteaders cut French's fences, burned his hay, and killed his cattle; he retaliated by buying their lands when they could not make payments.

The tensions between homesteaders and cattle barons over control of water escalated until finally, on December 26, 1897, a homesteader named Ed Oliver rode onto French's land. French and his crew were rounding up cattle and looked up to see Oliver galloping toward them. Oliver's horse struck French so hard that the horse fell to his knees, and French struck out with his whip, beating Oliver about the head and shoulders. Oliver pulled out a gun and began waving it about, whereupon French turned his back on the man and rode off. And then, in front of all the crew, Oliver shot the unarmed French in the back, killing him. The jury—made up of homesteaders and shopkeepers in Burns—found Oliver not guilty, agreeing with his claim that he acted in self-defense.

The empire French had built did not last long after his death. In 1906, the
French-Glenn Livestock Company was sold to Henry L. Corbett, the Oregon senator; he soon sold to Swift & Company, the meat-packing company, which reorganized the holdings into the Blitzen Valley Land Company. Hoping to subdivide their holdings and sell them off as small farms, the Blitzen Valley Land Company built extensive irrigation facilities and dredged twenty miles of the river. The development scheme never paid off, however. In 1916, the operation reorganized yet again, this time into the Eastern Oregon Livestock Company, running about twenty thousand head of cattle on the P ranch. Unlike Peter French, the managers failed to put up enough winter hay, and they lost 40 percent of the cattle in the next two winters. Feral hogs filled the tule marshes and bottomlands, and then sheep were brought into the valley, which did not exactly improve conditions. The effects of all this human, animal, and machine activity were soon apparent. In the early 1930s, drought hit, and combined with overgrazing, conversion to grain agriculture, dredging, channelizing, and elimination of much riparian habitat, much of the valley was reduced to dust. The land was sold once again, this time to the federal government, which wanted the Blitzen River water rights to protect water levels on the Malheur Lake Bird Reservation.

With the goal of restoring waterfowl nesting habitat in the valley, John Scharff, refuge manager from 1935 to 1971, began extensive engineering projects for the control of water. Scharff had grown up on a local ranch, and he was an enthusiastic proponent of management to increase production. With the help of the Civilian Conservation Corps, his staff bulldozed new ponds for chick-rearing habitat, built dams to hold water, dug ditches for irrigating meadows, and extended hundreds of miles of canals along both sides of the valley to supply water reliably to the entire floodplain. Instead of a system of wandering channels, where in some years only part of the valley might be wet, they created a landscape where they hoped to control which meadows were wet, which ponds stayed full of water, and which meadows were allowed to dry out.

To understand these decisions, we need to remember the desperate conditions of migratory bird populations in the first decades of the twentieth century—and the equally desperate attempts ornithologists and conservationists were making to save those birds. In the early 1930s, severe droughts along the Pacific Flyway desiccated wetlands, habitat that had already been drastically reduced by three decades of drainage and reclamation. By 1934, the continental waterfowl population dropped to a low of twenty-seven million birds; only 150 egrets and fourteen whooping cranes remained. Conservationists were convinced that preservation of habitat alone would ultimately be powerless against land speculators, reclamation engineers, and drainage districts bent on creating farmland out of wetland. The bleakness of the situation led conservationists to advocate what were basically engineering solutions for the restoration of Malheur, borrowing the same techniques that had helped devastate the marshes in the first place.

What John Scharff was doing with the Malheur Refuge waterways was not unusual for the era. The 1930s were a decade marked by national enthusiasm for wildlife conservation, and much of that enthusiasm was aimed at projects that actively manipulated habitat. In 1934, the Bureau of Sport Fisheries undertook the first nationwide program of stream surveys and habitat improvements.32 Throughout the West, the bureau began to restore and improve streams on public lands. The program's major emphasis was on structural engineering solutions, what managers such as Scharff termed "improvements." Often using CCC camp labor, between 1933 and 1937 restorationists throughout the nation built a tremendous number of in-stream habitat structures, such as rock dams to create pools for trout, riprap to stabilize stream banks, and deflectors to force streams to meander. Soon, many managers came to assume that all water sources needed improvement: structural engineering was not just for damaged streams, but for all streams.

Although the water control system at the refuge did quickly increase waterfowl habitat, trying to maintain the system led staff into continued complications. Until Scharff retired in 1971, the refuge's emphasis was on maximum waterfowl production. Anything that seemed to detract from waterfowl production was eliminated. When coyote and raven populations soared, lowering duck nest success, refuge staff set out poisoned bait, and then had to contend with increased rodent predation on eggs. When beaver returned to the valley and blocked up the irrigation ditches, staff trapped them out, even though the irrigation system was trying to replicate what beaver had created in the first place.33

The post-Second World War hatred of beaver in the valley reflected changes in national attitudes about wetlands and riparian management. As the wetland historian Ann Vileisis argued, after the Second World War, the Fish and Wildlife Service, the Bureau of Reclamation, the Army Corps of Engineers, and, above all, the USDA's Soil Conservation Service did their best to drain and ditch American riparian areas and wetlands into machine-like landscapes. For the Fish and Wildlife Service, the purpose was better duck habitat; for the other agencies, the purpose was better agricultural land.

Across much of the country, drainage had swept agricultural practice during the first decades of the twentieth century, but the Dust Bowl made many
question the practice. However, after the war, high agricultural commodity prices allowed many farmers and ranchers to begin draining wetlands again. This time, farmers had the help of the federal government, whose programs encouraged farmers to turn marginal areas into croplands.\textsuperscript{18} Soil Conservation Service agents considered drainage a fundamental conservation practice and provided farmers with bulldozers and draglines to dig ditches. Moreover, agents considered drainage a way to bring farmers into their network; by helping them drain lands, agents felt they could develop rapport with locals and establish their advisory role for other soil conservation projects, such as those to reduce erosion. The USDA's Production and Marketing Agency shared costs of on-farm drainage projects, paying farmers 60 percent of the costs of drainage. This grant, along with price supports for surplus crops, meant that federal subsidies effectively removed much of the risk of investing in turning wetlands into agriculture.\textsuperscript{20} Drainage became a patriotic mission, part of the postwar dream of using agriculture to feed a hungry world.\textsuperscript{21}

In 1954, the Federal Watershed Protection and Flood Prevention Act was passed (known as PL-566), creating a Small Watershed Program that would help the USDA agencies work with state and local governments to reduce large floods by damming streams high in watersheds. Because years of erosion had left many streams clogged with sediment, the program was also intended to channelize waterways to carry away floodwaters faster and more efficiently.\textsuperscript{22} Since the channelized streams would carry drain waters as well, drainage projects could also fall under this project. By 1955, 103 million acres of land had been organized into drainage systems, and $800 million had been spent on ditches, outlets, levees, and pumps. Soon, more miles of public drainage ditch than highway covered the country. During four years in the 1950s, drainage funded by the USDA converted 236,000 acres of waterfowl habitat into farms. The technology of the bulldozer accelerated channelization through the 1960s, for the machine made the work quick and cheap. The Soil Conservation Service undertook huge projects of what they termed "stream improvement"—straightening and deepening water courses, removing riparian vegetation, dredging sediments, and thoroughly altering hydrology.\textsuperscript{23} Within the Malheur Lake Basin, as throughout the West, projects funded by the PL-566 small watershed program were particularly popular with local landowners, even in a locale that professed to hate government projects.\textsuperscript{24}

By the 1950s and 1960s, weed control became another major objective for Scharff. Willows were cut, mowed down, and sprayed with herbicide for several reasons: to remove predator habitat, to make it easier for tourists to see the wildlife, to increase mowing efficiency in the hay meadows, to increase the number of acres that could be put into full cattle and duck production, and, most important, to decrease competition for water. Woody riparian plants are phreatophytes, meaning that they extend their roots into the water table and consume a great deal of water. As one 1967 federal report on the Malheur Basin argued, "Many people believe that the high consumption of limited water supplies by phreatophytes is one of the most serious problems in the West."\textsuperscript{25} Phreatophyte removal accelerated with the introduction of new herbicides—the 1955 Yearbook of Agriculture recommended that for complete control, one must repeat six sprayings of 2,4-D and 2,4,5-T, which later became notorious as Agent Orange.\textsuperscript{26} Water experts of the mid-1950s came to believe that they could create more water and control floods through such phreatophyte eradication programs.\textsuperscript{27} The plan, however, backfired. The very plants that managers thought drank too much of their water actually contributed to maintaining a high water table. Riparian hardwoods are thirsty plants, which was often why people cut them down, thinking they were stealing water from livestock and more useful trees. But using water does not always mean reducing the supply for everyone else. Instead, riparian vegetation can allow streams to continue flowing longer. Even while they steal water, those plants increase the available supply to other plants. Riparian plants make the boundaries between water and land more complex, slowing water flow and keeping dirt from flooding the streams. Their leaves shade the streams, reducing water temperatures. Their branches and deadwood fall into the water, creating deep pools of scoured gravel where fish can spawn, trapping debris, and forming dams. Refuge staff used to think all this was bad—the point of a stream was to move water from point A to point B as efficiently as possible. But the more people tried to simplify streams by channeling them and piping them and cleaning them up, the more the waters dwindled away. Riparian zones made the boundaries between water and land more complex, and John Scharff, like many other managers, believed that these complexities interfered with his efficient administration of nature.

The most spectacular of all programs that Scharff initiated was surely the carp control project. Pioneers had introduced carp into the nearby Silvies River during the late nineteenth century, hoping to create a reliable food supply.\textsuperscript{28} Few people proved to like the taste of carp, however, and carp populations soon exploded, with a host of unintended effects. Carp made their way from the Silvies River into Malheur Lake, perhaps during the high-water year of 1952, when floods flushed carp into the lake.\textsuperscript{29} Bottom feeders, carp
churned up sediments and destroyed sago pondweed. Because sago pondweed was a critical food source for waterfowl, duck populations plummeted at Malheur. By 1955, sago pondweed was almost gone from Malheur Lake, and by 1957 carp had made their way forty miles up the Blitzen River. This unnatural introduction, but profoundly natural in its unwillingness to abide by human rules—became a profound threat to the empire of ducks at Malheur.

Scharff responded by initiating a series of poisoning projects whose intensity and scope were made possible by two things: technological advances that had resulted from the Second World War and a worldview that had declared war on any aspects of nature that refused to accede to human control. Refuge staff set out to control carp by dumping and spraying the fish poison rotenone throughout the system—an enormous project, for it involved treating the Blitzen, the Silvies, and all their tributaries, and the lake itself. Several dry years meant the lake levels had dropped quite low, shrinking the lake surface. With an extensive dike that stretched across part of the lake, and with water control structures along the Blitzen River, the staff shut the lake even further, making carp control feasible.

In the fall of 1955, the poisoning began. With aerial applications of rotenone, then with drums of toxicant dumped into the water, and finally with staff wading out into the marsh and hacking the heads off dying fish, the refuge killed one and a half million carp. But two thousand carp escaped, spawned, and within three years carp were more numerous than before—now that their competitors, native fish much less resistant to rotenone, had been poisoned out. Control projects continued for several decades. Two more extensive aerial sprayings were undertaken during low water years, with equally limited success.

What decades of drainage efforts had failed to do, carp managed quite nicely: they transformed Malheur Lake from a splendid duck habitat to something still magnificent but far less productive for waterfowl. Carp had inadvertently created another nature—a monster to some, a place of incredible fecundity and stink to others. Nature kept recreating itself, a many-headed hydra, escaping from the bounds people attempted to place upon it. People were responsible for these monsters, but they had little luck controlling them. Scharff, however, was not troubled by the prospects of failure. Torpedo bombers, undiluted poisons, hacking the heads off millions of carp: anything was possible in the war to create a better nature. Eventually, however, after Scharff’s retirement, the refuge staff admitted defeat in the war against carp and focused instead on merely keeping carp populations from exploding to the point that they displaced everything else in the marsh. Instead of complete control, the refuge staff realized they would have to find an uneasy relationship of give-and-take with this new nature they had helped to create.

In Scharff’s era, refuge management was driven by visions of maximizing duck production, just as earlier management in the valley during the era of the cattle barons had been driven by hopes of maximizing cattle production. For nearly five decades, ranchers and refuge managers had, for all their conflicts, found common ground in the promises and hopes of progressive land management. Both groups believed they could reshape nature to increase production, thus engineering a brave new nature. Both groups believed that through water manipulations, the replacement of native riparian vegetation with exotics, the removal of competing animals and plants, and other forms of intensive management they could have cattle and ducks both.

By the 1980s, this faith began to crumble, largely because of floods that reshaped the face of the ecological and human landscape. Heavy snowfalls led to increasing water levels each spring, until by 1984 floodwaters filled much of the closed basin, wiping out farms one after another, washing out roads, ripping out culverts, and undermining the post-Second World War belief that riparian landscapes could be reshaped into an orderly agricultural and duck machine. What shifted with the waters were not just the boundaries between water and land, but cultural attitudes.

To understand the effects of the floods in the 1980s, it helps to step back and review local efforts at water development and flood control. Floods were nothing new; they had recurred for millennia. As ecologists had begun to argue in the early 1960s, floods were a critical element in the functioning of riparian landscapes. Yet while floods were certainly natural, the effects they had on the basin had changed dramatically in the past century. In pre-settlement conditions, many of the most damaging effects of floods had been buffered by abundant riparian vegetation. Riparian plants had slowed the speed of floods and reduced the erosive power of flood waters. Side channels, meanders, beaver dams, debris in the channels, and the sinuous, meandering, swampy landscape had all worked to moderate the impacts of floods. But farming, grazing, and channelization of the Silvies and Blitzen rivers had reduced the riparian landscape’s ability to absorb flood waters.

Those same human modifications also reduced people’s willingness to live with floods. Early ranchers who had flood-irrigated wild hay meadows had been relatively willing to live with the inconvenience of annual floods. Benefits from flooding had been clear to ranchers: water, lush grass growth, subirrigation, and sediment deposition that increased the quality of basin
The ranchers had recognized that if floods were cut off from their meadows, sagebrush and other upland vegetation would move in, reducing ranch income. Early ranchers had protected their houses and barns from the spring waters, and they had tried to manipulate where the flood waters ran in the spring, but they otherwise had been willing to adapt to the floods, living with both the costs and the benefits.

But as ranchers made the switch from wild hay to alfalfa in the 1950s, effectively turning their holdings into what Scharff called “beef factories,” they had been less willing to adapt to floods. John Scharff described this transformation approvingly: “The income is rising spectacularly on many ranches as the owners fertilize the meadows, replace sagebrush with grass, use water to better advantage, get higher calf crops, and perfect the hundreds of management factors that make a ranch a better beef factory.” To many locals who were struggling to “perfect” their beef factories, the problem seemed clear. Floods washed over the Silvies Valley early in the spring, making it impossible to get the heavy equipment needed for planting alfalfa into wet fields, while in the late summer, water needed for irrigating alfalfa ran out. Why not simply build a storage reservoir that would hold back the waters in the spring and release them in the late summer? Even though in the early twenty-first century Bureau of Reclamation officials had spent many years writing reports that declared such projects unfeasible, the political landscape changed when the Army Corps of Engineers came into the picture.

In 1941, the Flood Control Act had authorized the Army Corps of Engineers to survey rivers across the nation for flood control. In 1945, the district engineer of the U.S. Engineers Office had produced the “Report on Preliminary Examination for Flood Control of Silvies River and Tributaries, Oregon,” which recommended an extensive survey for flood control. In 1957, the Army Corps of Engineers finally published the results of this survey, arguing that local water conflicts had become acute because very little water from the Silvies ever reached Malheur Lake. Most was used in irrigation, and the rest went to percolation or evaporation. But while irrigation water was running short, the corps could write in 1957 that “irrigation practices are showing improvement on many of the ranches.” Primitive flood irrigation was beginning to give way to more efficient projects, as “Large earth-moving equipment has been brought into the basin and is available at reasonable cost for constructing levees, clearing or reconstructing canals, and similar operations.” Bulldozers had begun to allow extensive and relatively cheap channelization of local streams and waterways, not to mention the construction of levees that would keep flood water off the land.

The 1957 army report made the case for a storage and flood control reservoir, arguing that floods threatened efficient ranching. From the perspective of army engineers, the “destructive effects of annual flooding” made it difficult to grow “the better types of hay, generally limiting crops to native grasses.” The army report argued that floods were being made worse by “lack of adequate natural channel capacity.” What this seemingly innocuous statement assumed was that channels were not incised or damaged enough. If only they had become even deeper and wider and more degraded—if only they were more like ditches and less like rivers—then those channels could have contained the floods, engineers believed. The over bank flooding that ecologists and hydrologists now see as the major benefit of high water, army engineers saw as the major problem. The incised channels that ecologists now see as the central problem, engineers then saw as the solution.

To decide if the reservoir could be justified economically, the army calculated a cost-benefit ratio. Cost-benefit ratios were supposed to be a quantitative, and therefore unbiased, way of measuring the value of a project. Army planners estimated total construction costs at $5,454,000, with annual charges of $292,000. Annual benefits were estimated at $408,700. The report claimed that the cost-benefit ratio showed the project would be economically beneficial for the basin. The project did not go forward, however, because contested water rights derailed it, just as they had derailed every other reclamation project ever proposed for the basin.

Cost-benefit ratios were a favored tool for planners because they were seen as value free and therefore beyond attack. Numbers, rather than values or political alliances, surely had to offer a rational way of making decisions, planners believed. But values shaped the assumptions behind these calculations, and as values changed, the calculated cost-benefit ratio could also dramatically change. Twenty years later, in 1977, the Army Corps carried out another study on the same project in the same location, with new cost-benefit ratios that revealed some fundamental changes in values. This time around, estimated project costs were calculated to be over $19 million, three and a half times the cost projection from twenty years earlier (far outpacing inflation). The annual charges for the reservoir increased from $292,000 in the 1957 projection, to $3.5 million (an increase explained largely by the need to service debt from initial construction costs). Most strikingly, total annual benefits decreased to $395,000, so the cost-benefit ratio dropped to 0.11. As the report stated: “In view of the obvious lack of economic feasibility, it is recommended that this study be terminated and no action taken toward broad authorization of a project at this time.”


Where did these changes in calculated benefits come from? By 1977 the army had lost its optimism about the possible benefits from irrigation development. Rather than calculating the potential value of agriculture outputs from an entirely transformed basin, as the 1957 report had done, the 1977 calculations simply calculated the increase in value of irrigated hay. Planners therefore figured that the project would produce only $32,000 in annual agricultural benefits from irrigation (the rest of the $395,000 benefits came from flood protection).55

The Agricultural Research Station stridently opposed the army's calculations, arguing that the project could create a new agricultural machine in the basin that would produce, not $32,000 in annual benefits as the army calculated, but rather a $13 million profit each year. By using every drop of the average flow of the Silvies River each year to irrigate alfalfa, the Agricultural Research Station staff calculated farmers could produce 236,000 tons of alfalfa each year, worth at least $45 a ton or over $10.6 million. Farmers could then convert each and every acre of marshland in the entire basin to alfalfa. Once water was kept off the land, farmers could use groundwater irrigation to convert sagebrush to improved pastures. Cattle on those irrigated uplands would surely gain over seven hundred pounds of weight per acre, so farmers could get an increase of 10,545,000 pounds of beef over what they were currently producing. Then farmers could sell that beef for an extra $2,636,000 each and every year, leading to over $13 million in annual irrigation benefits, not a mere $32,000.56

The army responded by consulting with the Bureau of Reclamation, whose acting regional director gently pointed out some of the flaws in the station's projections: "The assumption that the entire runoff of the Silvies River, 118,000 acre-feet, would be available for crop production (available to the plants) is not valid. The requirement for minimum streamflows, losses from evaporation, and conveyance losses both off and on the farm would reduce this amount by perhaps 40 percent." Conversion costs, the regional director added, to change wild hay meadows into irrigated fields, would not be the $30 per acre figure offered by the superintendent of Squaw Butte, but rather at least $1150 per acre, and probably far more. In addition, the regional director asked, did the Agricultural Research Station really believe that all farmers could produce as much as the station's scientists produced on their experimental farms?57

The Agricultural Research Station's calculations existed in a dream world of imaginary agricultural perfection—a world in which Schaff's fantasy of the landscape as a "better beef factory" had been realized. But the superintendent of the Agricultural Research Station did recognize one critical point: that the army's cost-benefit ratios reflected cultural assumptions. He accused the army of lying, writing in a bitter protest letter that "sociological pressures, pressures from others relying on water from the Silvies, and the reluctance of land owners to conform to the acreage limitation may be of greater impact on this project than it 'not being economically feasible.' Please do not confuse the real issues by inferring that the construction costs exceeded the expected increase in income unless it is a fact."58

While some locals residents applauded the Army Corps's decision to shelve the project, others felt betrayed. Decades of study had resulted once again in the failure to construct a dam that could save the basin from its own natural vicissitudes. Just a few years after the flood control project was turned down, the worst dreams of planners and ranchers and farmers came true: floods that kept rising, year after year, until water had rewritten the story of the human and natural landscapes.

Heavy snows began in 1982 and continued for several winters, leading to slow but inexorable rises in lake levels. No wall of water came hurtling into town and no great floods of meltwater ripped through the basin, tugging children from their mother's grasp. The waters rose slowly, spread slowly, and seeped slowly through the basin. By June 27, 1984, Malheur Lake had reached 4102.4 feet; nearly nine and a half feet above the normal lake maximum of 4093 feet.59 Nine and a half feet of water may not sound like much, but in a flat basin, a little bit of water goes a very long way: each one-foot rise in lake levels submerged another 8500 acres.60 Instead of dropping, the lake continued to slowly rise with each wet year that followed, until by 1986, the lake had reached 4102.6 feet high.61 While an average lake surface area of about 46,000 acres had seemed normal for Malheur Lake, by June 1984, Malheur, Mud, and Harney lakes had merged, eventually covering more than 170,000 acres, becoming the largest lake in the entire Pacific Northwest.62

The local economy, already hurting, suffered tremendously. After a railroad washout in March 1984, the Union Pacific Railroad closed its spur line between Burns and Ontario, Oregon.63 This line had been used to transport lumber from the sawmill in Burns, and so lumber had to be trucked out, an expensive proposition.64 Parts of two highways were submerged, along with fifty-seven thousand acres of marsh habitat. Twenty-five ranches were badly damaged, thirty families were displaced, power and telephone lines were destroyed, carp populations skyrocketed to some 80 to 90 percent of fish biomass, groundwater was contaminated with arsenic, and fifty thousand acres of hay were lost.65 Much to locals' anger, the State of Oregon and the federal
government refused to declare the county a disaster area and refused to release emergency relief funds, largely because the slowly rising waters of a Great Basin flood did not meet outsiders’ perceptions of what a flood should be: a sudden, sharp mess.39

The Army Corps was called in once again to solve the problem, and after several years of study (and several years of mounting frustration among locals), the corps proposed three possible solutions to the flooding: a dam and reservoir, a canal system that would drain Malheur Lake into the Columbia River system; and a nonstructural solution that would move the railway line out of the floodplain and purchase flood-prone lands from the ranchers. The cost of the proposed reservoir had ballooned to $130 million (up from $10 million seven years before, largely because the army engineers realized a much bigger dam would be needed to control floods). The annual cost of this reservoir solution would be $13.1 million, which even for army engineers seemed a bit steep in a basin where the most profitable crop was hay.40

The army figured a much cheaper solution would be to drain water from Malheur Lake through a seventeen-mile-long canal into the Malheur River, which then flowed into the Snake River, then the Columbia River, and from there to the Pacific Ocean itself. The initial 1985 army reconnaissance report estimated the annual cost of the proposed canal at $4.4 million. The report estimated that the annual benefit of flood control would be worth $2,160,000. Malheur Lake water could be sold to the hydroelectric dams on the Columbia River system, planners figured, and those annual power benefits would be worth $4,332,000, leading to a cost-benefit ratio of 1.5:1. The 1985 reconnaissance study concluded that the canal “could be an effective solution to flooding around Malheur Lake and provide economic and social benefits.”41

These estimates of costs and benefits, while seeming perfectly rational at first glance, proved insupportable even for the army. Most of the calculated annual benefits came from the sale of hydropower at dams on the Snake and Columbia rivers. But, as an army report published two years later admitted, power benefits would mostly occur only in the first two years, as drawdown occurred. After that they would be brief and intermittent only.42 Moreover, the army had estimated annual flood benefits of over $2 million. Critics quickly pointed out that several years earlier, in the 1977 report, the army itself had estimated annual flood reduction benefits at only $277,000.43 If the worst flood in one hundred years had produced $1.2 million worth of crop damage, how could flood benefits total over $2 million a year? In a basin that produced such low-value crops, how could it be economically feasible to construct a project that cost far more each year than the crops were ever worth?

By the time the army completed the full report in 1987, their new calculations revealed much higher costs for a much smaller project. The revised canal would hold only half as much water, preventing only about 58 percent of flood damages in the future while reducing hydropower benefits. It would be those power benefits, not flood protection, that might make the plan economically feasible.44 The army calculated an estimated cost to complete the project at $20,900,000, with estimated annual costs of $1,846,000. The annual benefit would total $1,685,000—but the army calculated that annual benefits to farmers would be very small, and most of the annual benefits would derive from the hypothetical hydropower production sales.45

While economic calculations showed that the project was marginally unfeasible economically, what about the environmental consequences? By 1987, the Army Corps of Engineers was required by law to detail possible environmental consequences. The report reveals that, although planners did analyze possible effects, their own values prevented them from paying much attention to what those effects might mean for the ecosystems involved.

The primary environmental concern was that water quality in the Malheur River might suffer, eventually contaminating the Snake River and the Columbia River. Malheur Lake, as an inland sump basin, had the high levels of dissolved solids found in nearly all Great Basin lakes. Evaporation from Malheur Lake, as from most closed basins, concentrated dissolved solids, and the pH of the lake was usually above 7.0. Boron and arsenic concentrations were also high.46

What the canal system to save Malheur Lake from its own variability represented was not just an attempt to control a few floods, but an attempt to reshape nature in profound ways by changing a Great Basin watershed into a Pacific Ocean watershed. Malheur Lake is now part of a Great Basin watershed, closed from the sea. This system seems part of its essential nature: it is salty, stinky, filled with boron and arsenic and salts and fishes that have been trapped in their closed basins for many millennia. Intentionally changing the lake from one system to another would have led to a cascading set of environmental complications: What would carp do to the native fish communities in the Malheur River? Would they wipe out the native trout fisheries? If the proposed canal were to link Malheur Lake with Malheur River, the Oregon Department of Fish and Wildlife feared that the native trout fishery would be destroyed. The carp that filled Malheur Lake would find their way into the upper Malheur River, degrading the river as they had degraded the Malheur Lake. The Oregon Department of Fish and Wildlife estimated that the annual fisheries losses would amount to at least $500,000, an amount not figured into any army calculations, even though the potential economic loss far exceeded the potential estimated benefits to farmers.47
Would the alkaline, arsenic-laden water from the lakes destroy something essential about the Malheur River, a river that had already been profoundly altered by irrigation? What would those alkaline waters do to the threatened and endangered salmon runs in the Snake and Columbia Rivers? The Army Corps never constructed this canal system, but not because of environmental consequences. Construction costs had risen too high to justify the new cost-benefit ratio, so army economists finally advised against the project.

In this remote watershed, ranchers, irrigation speculators, homesteaders, and wildlife biologists competed for control of the uncertain boundaries between water and land. All the groups that have lived and worked in the Malheur basin have changed the connections between water and land, and all of these changes have led to unintended consequences. But the moral of this story is not that everything people have done has degraded the ecosystem. The effects of different groups were profoundly different.

Some groups tried to bring stability to these flood-prone landscapes, hoping to create a predictable machine that could maximize agricultural or waterfowl production. They cut the connections between water and land, often with disastrous effects. In the short term, this increased cattle, hay, and ducks. In the longer term, their efforts destabilized what they had been trying to stabilize.

Some people, such as the earliest ranchers and recent refuge managers, manipulated water’s boundary with land without ever hoping to achieve complete control over either, and without trying to completely separate them. Although French and other early ranchers certainly simplified nature, they did so with surprising sensitivity to ecological conditions, as they sought to accommodate their grazing regimes to intermittent flooding. They manipulated water’s boundary with land without ever hoping to achieve complete control over either, and without severing the connections between water and land. Rather than trying to lock rivers and streams within their channels, they learned to take advantage of the richness offered by periodic chaos. Rather than trying to regulate and engineer change out of existence, they learned to live with variability.

In the years since John Scharff retired, management of Malheur riparian areas has become less clumsy, but no less manipulative. Now, instead of using bulldozers to channelize the river, the staff is trying to figure out ways to use bulldozers to return the river to its old meanders. Willow are being planted instead of being ripped out, but herbicides still play a role, removing vegetation that might compete with desired native species. The irrigation and water control system grows ever more elaborate, since without it much of the habitat for rare and endangered birds would be lost. Flood irrigation still waters the meadows, but now it creates hay for bird cover, not just for cattle.

The most profound change in the Blitzen Valley is that refuge staff are no longer trying to fix a single pattern of ponds and meadows and wetlands in place. Instead, they are trying to manage variability back into the system by alternating which meadows are dry and which are wet. Yet, given the constraints of managing a wildlife refuge with extensive investments in structural improvements, this variability can be allowed only within strict limits. For example, the river is now encouraged to meander a little, but not enough to threaten the constructed canals and brood ponds.

Some critics of Malheur Refuge policy have recently argued that the water control system should be dismantled, and natural variability should be allowed to have full sway. But is this possible in a world so dramatically altered by people? Before extensive water control systems, some years water levels were so high that numerous pools and ponds formed in the valley, perfect for brooding waterfowl. Other years few pools formed, and waterfowl nesting habitat was minimal. This historic variability existed within an entirely different context, however. Malheur Refuge was once only one of a long string of fertile, vast marshes stretching up and down the Pacific Flyway. Much of the Great Basin was stopover habitat for migratory birds needing to rest and feed up on their long journeys to the Arctic. If most of the Malheur Lakes Basin happened to be dry one year, the birds could stop elsewhere, because the Pacific Flyway consisted of numerous patches of desert, riparian, and wetland habitats.

Now, however, the vast majority of those historic riparian areas and marshes are gone, lost to agriculture, shopping malls, and highways. Malheur Refuge has become a critical habitat in a way it never was before. If natural variability were returned at Malheur, it might be disastrous for entire populations of ducks, sandhill cranes, and shorebirds. Until millions upon millions of acres from California to Canada have been restored back to wetland and riparian meadow, allowing natural systems to work entirely without human intervention is as unnatural as trying to gain control over every drop of water and every act of predation.

Refuge managers feel, in other words, that they cannot allow natural systems to be purely natural. Managers try to restore some natural variability, but not enough to threaten the water systems that have been painstakingly constructed. There is nothing ideologically pure about current refuge policy: it is not an attempt to return to pristine natural conditions, nor is it an attempt to gain complete control of nature.
Such a policy infuriates some environmentalists, who see little difference between John Scharff’s regime and current refuge attempts to limit predators and regulate water. But this view misses crucial differences. Scharff, unlike current managers, did aim for ideological purity: his ethic was one of control and improvement. He rarely seemed to doubt that humans could and should take complete control of nature. Likewise, some modern environmentalists have an ethic that is equally ideologically pure: the ethic of naturalness. A thing is good when it is natural, bad when it is not. Controlling predators or water is unnatural, so therefore it is bad.

In the world that refuge staff actually have to work in, neither ethic is particularly helpful. Refuge staff muddle along, trying to find some reasonable path between extremes, zigzagging back and forth between trying to manage ducks and cranes, fish and maggies. The refuge managers are trying to act pragmatically, rather than ideologically. They are not trying to restore the refuge to some past set of pristine ecosystems; they are trying to adapt to change, making things work as best they can, while minimizing future complications.

Such pragmatic decisions are the key to adaptive management, which is the messy process of developing a management scheme that incorporates multiple human perspectives while also responding to changing scientific understandings of dynamic ecosystems. At its best, adaptive management is a way of paying close attention to what happens when we manage landscapes, and then altering practices when old ways no longer produce the desired results (or when the results that people desire change). This approach, at heart, is simply applying the scientific method to management. Everything managers do is nothing more, and nothing less, than an experiment. Experimentation means approaching the world with an open mind. As a scientist, you are supposed to treat your own ideas with humility, abandoning your hypotheses if the results are not what you expected. This process is never completely open-minded; initial ideas about how the world ought to work shape what you see. But there is an important ideal here, of allowing the natural world to shape your ideas, and not just the other way around. In other words, there is a kind of give and take, a willingness to be surprised. The critical step for management, however, comes after the research: the hard part is using all that information to change how you work with the land. Adaptive management does not necessarily mean big government programs: what it means above all is people on the ground being responsive to what the land is telling them, and being responsible for acting on that knowledge. It means a dialogue between people and land; it means people knowing the place they work. Adaptive management at its best is an interactive process that yields new information about ecological and human systems and then uses that information to develop policies that can respond to changing knowledge about a changing world.

Managers such as John Scharff long hoped that they could engineer the riparian landscapes to produce a stable output of what people most desired, but the watery landscape proved far too dynamic for this. In the 1930s, refuge managers made reasonable engineering decisions in a desperate situation, developing a set of powerful water manipulation techniques that make excellent sense in a particular context, given the challenges waterfowl populations faced at the time. But as Scharff gained power, these ideas became increasingly rigid. By the 1940s, refuge staff proved slow to respond to information that suggested their scheme was leading to trouble. When events at the refuge began to spiral out of control, managers did not question their own basic assumptions but instead tried to hold the system under increasingly rigid control. Management techniques at Malheur that began as experiments soon became orthodoxy. People found it difficult to challenge the developing orthodoxy until outside events—floods, litigation, and pressure from environmental groups—forced refuge managers to take new perspectives seriously. Conflict forced people, institutions, and states to incorporate new ideas into their worldview.

At Malheur National Wildlife Refuge, management’s path is now as indirect as the river’s course once was. Legal battles constantly reshape refuge policy, much to the eternal frustration of staff who are trying to get their job done. But such outside influence is a good thing in the long run, however annoying it is from day to day. Without criticism and political pressures and court cases, refuge management would be far more efficient—and in the end, far more problematic.

When managers work in isolation, they can come to operate with the ideological certainties that drove John Scharff’s plans. Recent managers at Malheur have had a far more difficult time getting things done than Scharff ever did, for they have been bogged down in court cases, tied up in endless negotiations with different stakeholders, distracted by petitions to list native fish, and dragged into fights with hot-tempered neighbors. While these are all enormous hassles, they offer a way for federal agencies to chart a responsive course in a changing political, social, and ecological landscape.